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ON THE LIFE HISTORY OF THE CHICKEN CESTODE
HYMENOLEPIS CARIOCA (MAGALHAES)*

JOHN E. GUBERLET

The problem of tapeworm infestation in chickens has received some attention during the last few years. The investigations being carried on at present are chiefly those with regard to the life cycle of the various forms. Of the six species found in the United States three have been demonstrated experimentally. *Davainea proglottina* (Davaine) was transmitted experimentally to chickens through the slug, *Limax cinereus* Lister, by Grassi and Rovelli (1889:372; 1892:86). This species has been reported from only a very few localities in this country. *Choanotaenia infundibuliformis* (Goeze) was transmitted through the common house fly, *Musca domestica* Linn., by the writer (Gutberlet 1916a:235; 1916b:30). *Davainea cesticillus* (Molin) has also the house fly, *Musca domestica* Linn., as its intermediate host (Ackert 1918:41).

Recently, the writer has demonstrated experimentally that the stable fly, *Stomoxys calcitrans* Linn., may transmit to chickens another tapeworm, *Hymenolepis carioca* (Magalhaes 1898). The chickens used in these experiments were hatched in an incubator and placed as soon as coming from the eggs in insect proof cages. Great care was taken in feeding the birds so that no insects entered the cages or were given to the birds with the food. The chicks were fed grain and a small amount of green feed which was carefully inspected.

The experiments were carried on at two different times and the cestodes were obtained from the birds on both occasions by postmortem examinations. In August, 1914, on a farm at Hardy, Nebraska, the writer placed six chicks as soon as hatched into an insect-proof cage. Three were used in the experiment and the remaining three were used as controls. Large numbers of *Stomoxys calcitrans* were taken on August 18, 19 and 20 from around the chicken house and yards and given to three of the chicks. The chicks were all killed on August 29 and two (one was two and one-half weeks old) of the three experimental chicks each harbored seven small cestodes. The other chick as well as the three controls were free from parasites. The writer was compelled to give up the work at that time on account of a change of location and consequently could not carry on the experiments any farther until the autumn of 1918. On December 16-19 seventy-seven

* Contribution from the Parasitology Laboratory of the Oklahoma Agricultural Experiment Station.

flies, *Stomoxys calcitrans*, were given to a chick reared in an insect-proof cage at the Poultry Plant of the Experiment Station at Stillwater, Oklahoma. More flies could not be obtained at this time of the year because of cold weather. This chick was killed on February 11, 1919, and upon examination was found to harbor three mature worms of the species *Hymenolepis carioca*. From the same cage twenty-four other chicks used for other experiments were killed and in no case was there an infection with this species.

At the time when this experiment was carried on in Nebraska the infestation with *Hymenolepis carioca* was very heavy in nearly all of the chickens on the farm and at the same time the *Stomoxys calcitrans* were particularly numerous. At the Poultry Plant of the Oklahoma Experiment Station this species of cestode was not common until in November and December when the chickens became very heavily infested. During this period the *Stomoxys calcitrans* also were very abundant about the poultry yards. This was more evident on account of the scarcity of other species of flies. At this season of the year these flies seem to be somewhat sluggish and inactive and consequently become easy prey for chickens.

Large numbers of flies of the species *Stomoxys calcitrans* were fed on onchospheres and fragments of mature proglottids of *Hymenolepis carioca*. The flies during the course of the feeding experiment were fed on milk, syrup and small amounts of sterile chicken droppings which they ate very readily. The flies were kept alive as long as possible and when they died they were preserved for sectioning.

Hymenolepis carioca (Malgalhaes 1898) Ransom 1902

Diagnosis: Length 20 to 110 mm. Breadth at neck 75 to 150 μ , at posterior end 0.4 to 0.8 mm. Segments three to five times or more broader than long throughout strobila. Head (Fig. 1) flattened dorso-ventrally, 140 to 160 μ long, 150 to 215 μ wide and 100 to 150 μ thick. Suckers shallow, 75 to 100 μ in diameter, armed with hooks (Fig. 2) 6 to 8 μ in length with short ventral root and dorsal root a mere knob. Rostellum (*r*) unarmed; in retracted position 25 to 45 μ in diameter and 90 to 110 μ in length with a small pocket (*rp*) opening to exterior in anterior position. Unsegmented neck portion of strobila 0.6 to 1.5 mm. long. Genital pores almost entirely unilateral, a single pore being located in each segment slightly in front of middle of right hand margin.

Male Reproductive Organs: Testicles three in number, normally two on left and one on right of median line. On dorsal side of inner end of cirrus pouch vas deferens is swollen into prominent seminal vesicle (*sv*) which may attain a size of 70 by 50 μ . Cirrus pouch (*cp*) in sexually mature segments 120 to 175 μ long by 15 to 18 μ in diameter; almost cylindrical, slightly curved toward ventral surface of segment;

on outer surface about 20 longitudinal muscle bands, 2 to 3μ in thickness, very prominent in cross section; vas deferens enlarged within cirrus pouch to form small reservoir occupying proximal portion of pouch; distal portion of vas deferens within pouch very slender and functions as cirrus. Genital cloaca 12 to 20μ deep.

Female Reproductive Organs: Opening of vagina in floor of genital cloaca, ventral and posterior to cirrus opening. First portion of vagina very narrow, 1 to 2μ in diameter. Vagina passes inward past excretory canals and in sexually mature segments becomes swollen into prominent seminal receptacle (*sr*) which extends forward to anterior border of segment and inward to proximal end of cirrus pouch. Ovary (*o*) faintly bilobed or trilobed in posterior half of proglottid. Yolk gland (*y*) spherical or ovoid 30 to 40μ in diameter, situated near median line of segment, posterior and dorsal of ovary. Uterus at first a solid cord of cells extending transversely across segment along anterior border of ovary; becomes hollowed out and grows backward on dorsal side of ovary; in gravid segments (Fig. 4) occupies nearly entire segment and filled with eggs. Embryos (Fig. 5) in gravid uterus spherical or oval, with four membranes, the two middle membranes often approximated to form thick layer which shows a somewhat granular structure. Diameter of outer membrane 38 by 38μ to 80 by 75μ , of outer middle membrane 32 by 32μ to 70 by 65μ , of inner middle membrane 26 by 26μ to 45 by 40μ , of inner membrane 24 by 18μ to 32 by 24μ . This membrane lies so close to onchosphere that it is almost impossible to distinguish it from embryo. The embryonic hooks penetrate this membrane. The onchosphere is 22 by 16μ to 30 by 22μ in diameter; onchospheric hooks (Fig. 6) are 8 to 10μ in length.

This thread-like worm, according to the above observations, seemed to be most numerous during the late summer and fall at the seasons of the year when *Stomoxys calcitrans* are very abundant. During the autumn this species of fly is less active and consequently is more easily taken by chickens. Experimentally infesting chicks with *Hymenolepis carioca* through feeding infested stable flies *Stomoxys calcitrans* under control conditions makes it evident that this species of fly may be the intermediate host of this species of chicken cestode.

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EXPLANATION OF PLATE

- Fig. 1.—Scolex of *Hymenolepis carioca*, $\times 160$.
Fig. 2.—Hooks from suckers. Free hand drawing, \times about 2000.
Fig. 3.—Reconstruction of proglottids showing organs, $\times 200$.
Fig. 4.—Section of ripe proglottids showing gravid uterus, $\times 40$.
Fig. 5.—Embryos with membrane, $\times 600$.
Fig. 6.—Onchospheric hooks, $\times 600$.
Drawings made with aid of camera lucida.

ABBREVIATIONS

<i>cp</i> — cirrus pouch	<i>rp</i> — rostellar pocket
<i>dex</i> — dorsal excretory canal	<i>sr</i> — seminal receptacle
<i>vex</i> — ventral excretory canal	<i>sv</i> — seminal vesicle
<i>o</i> — ovary	<i>t</i> — testes
<i>r</i> — rostellum	<i>y</i> — yolk gland

GUBERLET—LIFE HISTORY OF CHICKEN CESTODE

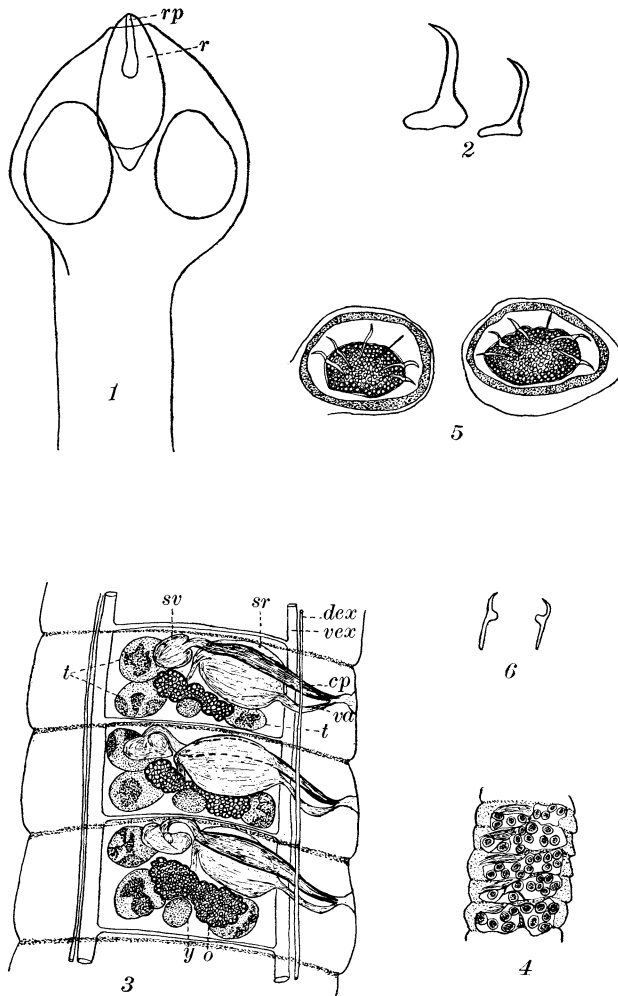


PLATE IV